



TSMC2001-045

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July 29, 2002

#5 Response  
M. Brinson  
8/27/02

To: Commissioner of Patents and Trademarks  
Washington, D.C. 20231

ATTN: Group Art Unit 2814

T. T. Doan

From: Stephen B. Ackerman, Reg. No. 37,761  
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| Serial No. 09/992,458 11/16/2001 |

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A METHOD FOR MAKING METAL CAPACITORS WITH LOW  
LEAKAGE CURRENTS FOR MIXED-SIGNAL DEVICES

| Group Art Unit: 2814 T. T. Doan |

RESPONSE TO PATENT OFFICE ACTION

Dear Sir or Madam:

The Commissioner is hereby authorized to charge payment of any additional fees involved with added Claims and the like to Deposit Account No. 19-0033.

In response to Office Action dated May 08, 2002, please consider the following remarks pertaining to the above application for patent.

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231 on August 7, 2002.

Stephen B. Ackerman, Reg. No. 37,761

Signature

Date 8/7/02



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REMARKS

Examiner T. T. Doan is thanked for a complete search and thorough Office Action.

Reconsideration of the rejection of claims 1, 4, 16-17, and 19 under 35 U.S.C. 102(e) as anticipated by Alers et al., U.S. Patent 6,320,244 B1 is respectfully requested for the following reasons.

The applicant's invention is a method for making a MIM capacitor that has high-dielectric-constant material and also utilizes a wide band-gap (low-k dielectric) material to minimize leakage currents. The wide band-gap material is very thin (10 to 50 Angstroms) and is sandwiched between the electrodes and the high-dielectric material.

Referring to the Examiner's Office Action, page 2, Item 2, the Examiner states

"...depositing a first wide-band-gap insulating layer 64 on the bottom electrode; depositing a multi-layer of high-k dielectric film 66 over the wideband-gap insulating layer; depositing a second wide-band-gap insulating layer 68 over the multi-layer;..."

The details of Alers' process for making the capacitor dielectric 46 as a composite dielectric are described in column 7, lines 27-39. Alers does not use or suggest a wide band-gap dielectric, but describes using metal oxides with a relatively high dielectric constant, such as  $\text{TiO}_2$ ,  $\text{ZrO}_2$ , and

$\text{RuO}_2$ . The use of these relatively high-dielectric constant metal oxides directs one away from the applicant's invention which uses a wide band-gap dielectric to minimize leakage currents. It is not clear where the Examiner is referring to the use of a wide band-gap insulator in Alers' text, as cited by the Examiner on page 2 of the Office Action.

Since Alers et al. direct one away from the applicant's invention, the applicant's invention, claim 1, is not anticipated and is patentable over by Alers et al.

The applicant's claim 4 is a dependent claim that does not stand on its own merit but is in support of the independent claim 1.

Since the applicant uses the wide band-gap layers to reduce the leakage current between the capacitor electrodes and the multilayer of high-k dielectric films, the argument cited above is still valid for the independent claim 16, which is for a second embodiment of the invention. Therefore, the applicant's invention, claim 16, is not anticipated by Alers et al.

Applicant's claims 17 and 19 are dependent claims that does not stand on their own merits but are in support of the independent claim 16.

Reconsideration of the rejection of claims 2-3, 5-15, 18 and 20 under 35 U.S.C. 103(a) as being unpatentable over Alers et al., U.S. Patent 6,320,244 B1, in view of Yoon et

al., U.S. Patent 5,688,724, is respectfully requested for the following reasons.

Referring to page 3, item 3, the Examiner states "...depositing a first  $\text{TiO}_2$  wide-band-gap insulating layer 64 on the bottom electrode (column 7, lines 29-32);"

Alers et al. actually deposit a metal oxide with a relatively high dielectric constant. Alers et al. are silent on the use of a wide-band-gap insulator. Therefore, it is not clear where the Examiner is referring to in Alers' text that cites the use of a wide-band-gap insulator.

As the Examiner points out on page 4, Yoon et al. teach the use of a dielectric layer such as  $\text{SiO}_2$ ,  $\text{TiO}_2$ ,  $\text{Si}_3\text{N}_4$ , and  $\text{Al}_2\text{O}_3$ .

However, though Alers et al. teach the use of a relatively high dielectric constant, such as  $\text{TiO}_2$ ,  $\text{ZrO}_2$ , and  $\text{RuO}_2$  and does not direct one toward the use of a wide-band-gap insulator, one would not be motivated from Yoon et al. to substitute an  $\text{Al}_2\text{O}_3$  insulator for the  $\text{TiO}_2$  insulating layer in Alers et al. Therefore, since Alers et al. do not teach the applicant's invention, then Alers et al. in view of Yoon et al. do not make obvious the applicant's invention claim 10.

Claims 2-3, 5-9, 11-15, 19, and 20 are dependent claims that do not stand on their own merits but support their respective independent claims 1, 10, and 16.

Allowance of claims 1-20 is respectfully requested.

TSMC2001-045

It is requested that the Examiner T. T. Doan call the undersigned Attorney at (845) 452-5863 should there be anything that can be done to help bring this Patent Application to Allowance.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'SBA', with a stylized flourish extending to the right.

Stephen B. Ackerman

Reg. No. 37,761